

AFN Network+ Scoping project:  
*Changing Agri-Chicken  
For Net Zero.  
Findings from an industry  
workshop.*



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Most of us met at the 2-day Bristol Crucible meeting hosted by AFN Network+ in June 2023. Following several ice-breaking and round-table activities a project started to take shape as we got to know each other, recalled the conversation we had had the previous day, an idea started to form. We have greatly appreciated the opportunity to begin our net zero research journey into the food system, and especially poultry, from being able to take part in this event. We embarked on this project as a brand-new team. No one had worked together previously. And in doing so we brought together a range of different disciplines – cultural geography, rural food geography, food systems geography, business studies, veterinary science, poultry welfare science and a poultry industry R&D specialist. It was a very rapid process of developing an idea, pitching it, writing it up in a form outside the standard UKRI bidding process, getting the good news we had been successful and then starting.

The partnership with Applied Group has been critical to what we have achieved. Many thanks go to all the industry participants that attended the workshop and continued the conversation in various ways.

We have really enjoyed getting to know each other, a particular highlight was meeting in Chesterfield for the workshop in December 2023, and then many of us reuniting again to run Build A Chick with the public at the Science and Engineering Fair at Southampton University. This was only a Scoping Project but our ambition and passion for the urgency of the research need has encouraged to do as much as possible with the relatively small sum of money available. It helped also that there was plenty of bonhomie between us and the fascinating discussions and learning that has been on offer by holding conversations together. Thank you for the opportunity AFN network+, and we hope our scoping findings help develop further questions and debate in the future.

*The Research Team.*

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## Executive Summary

The UK's poultry industry is a vital component of the agri-food sector, contributing to food security, employment, and economic growth. Data from the Department for Environment, Food, and Rural Affairs (DEFRA) indicates that poultry meat accounted for about 50% of total meat production in the UK in 2021. Additionally, it plays a crucial role in meeting the dietary protein needs of the population. As the UK commits to achieving net-zero emissions by 2050, the agri-food system is increasingly seen as a vital component of mitigation. In 2018, a UK government report, indicated that the UK agriculture sector accounted for approximately 10% of the nation's GHG emissions, with the poultry industry contributing less than 10% in the sector. However current estimates by the World Emissions Data team in 2024 attribute a quarter of total UK GHG emissions to agriculture, as other sectors have improved.

To achieve the 2050 net-zero emissions goal, the UK government amended the 2008 Climate Change Act in 2019, emphasising action as a balance between reducing emission sources and increasing carbon sinks. As a result, several agri-food pathways were identified to contribute to meeting the 2050 net-zero target. Despite having a lower carbon footprint than other livestock industries – chickens are over 10 times as effective as cows at turning food into meat, but the appetite for chicken in the UK is greater, three birds are growing for every British citizen at any time<sup>1</sup>. The UK Net Zero Strategy mandates the UK poultry industry to radically alter operations to lessen their impact on the environment and increase resilience to the effects of climate change, both directly and indirectly, by 2050. Consequently, changes to poultry feed and management, coupled with sustainable intensification of production, were highlighted as primary pathways to reduced emissions.

‘Changing Chicken for Net Zero’ was a Scoping Project funded by the UKRI Agri-food for Net-Zero network (AFN+) it ran Sept 2023 to June 2024. This report discusses findings from a research workshop with stakeholders in the UK poultry industry held in December 2023. The workshop explored participants beliefs and practices linked to awareness of engaging with net zero using participatory research methods. The aim was to advance understanding of how this group understood opportunities for action, both their own and others, within the food system to support the UK government’s 2022 Net Zero Strategy for the agri-food system. The findings from the workshop reveal i) how the industry speaks of operating amidst increasingly negative public perceptions, despite making what workshop participants viewed as considerable efforts towards sustainable practices and net zero; ii) we observed scepticism towards the very meaning of ‘net zero’; iii) views that the future of commercial poultry production is threatened by growing environmental, labour, and welfare concerns, whilst at the same time chicken production and consumption are expected to increase; iv) despite industry research on issues like biosecurity, sourcing of feed, feed crop production, pollution, and waste, the intricate and interconnected nature of the industry makes it challenging for poultry producers to determine effective strategies for change or transition to net-zero; v) efforts to reduce carbon emissions

require concerted effort from industry stakeholders, policymakers, consumers, and the public to transition towards more sustainable practices. Analysing these findings we recognise that the conversations generated by particular workshop activities reflect how actions to meet net zero are currently known, understood and envisaged. The conversations also reflect where beliefs lie about what changes appear hard to envisage as feasible. And that while regulatory frameworks and incentives for adopting environmentally friendly technologies are critical for driving innovation and aligning the sector with net zero goals, a commitment to large-scale transformation and visions for this poultry system are essential to establish and what part everyone will play, are essential. On paper this future is easy to envision and argue for, but it was not regarded as achievable in current poultry business models where distributed system-level interventions, involving industry, food retail and government actors, are rare. This explains why, when asked to envision poultry systems of the future, visions tended to be related to farm-level technology, circular farming and efficiency gains, as opposed to bolder macro-transformation.

## 1. Introduction

UK chicken production<sup>2</sup> and consumption has rocketed over the last 50 years. In 2022, almost 1.1 billion broilers, a chicken bred specifically for meat production, were slaughtered in the UK valued at £2.9 billion; and the UK produced 1.0 billion dozen eggs, valued at £818 million<sup>3</sup>. In 2022 the UK produced 1.7 million metric tons of broiler meat; imported 503,000 metric tons of predominantly white poultry breast meat; and exported 254,000<sup>4</sup> of less-desired poultry cuts to the UK consumer. It is known that the contemporary industry has an impact on environmental and human health<sup>5</sup>, related to its large environmental footprint including composite feed sourcing, particularly soya beans sourcing, alongside negative widely publicised impacts on river systems linked to nutrient management. Despite having a lower carbon footprint than other livestock industries – chickens are over 10 times as effective as cows at turning food into meat, but the appetite for chicken in the UK is greater, three birds are growing for every British citizen at any time. All of this is despite the industry's effort in adopting sustainable practices for net-zero such as heating and solar energy, manure treatments and technological innovation. Indeed, the UK's poultry sector is described by the National Farmers' Union (NFU) as a resilient, adaptable, and resourceful sector, delivering affordable and nutritious protein options for consumers<sup>6</sup>.

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<sup>2</sup> 'Chicken Meat Production', *Our World in Data* <<https://ourworldindata.org/grapher/chicken-meat-production?tab=chart&country=~GBR>> [accessed 17 March 2024].

<sup>3</sup> Emma Bedford, *Poultry in the United Kingdom*, 2024 <<https://www.statista.com/topics/6102/poultry-in-the-united-kingdom/>> [accessed 17 March 2024].

<sup>4</sup> Bedford.

<sup>5</sup> Goran Gržinić and others, 'Intensive Poultry Farming: A Review of the Impact on the Environment and Human Health', *Science of The Total Environment*, 858 (2023), p. 160014, doi:10.1016/j.scitotenv.2022.160014.

<sup>6</sup> 'NFU Poultry Sector Business Resilience Plan' <<https://www.nfuonline.com/updates-and-information/poultry-sector-resilience-plan/>> [accessed 16 May 2024].

The UK aims to meet net-zero emissions by 2050, with the agri-food system set to play a crucial role to achieve this target<sup>7</sup>. According to World Emissions data<sup>8</sup>, agriculture is the sector in the UK with greatest emissions in 2024, making up over a quarter of total national emissions. Awareness about sustainability and thinking about how the poultry industry could reduce its carbon footprint started in the early 2000s, it is only in the last decade that conversations have evolved around the concept of ‘net zero’. While the current poultry industry accounts for 2% within the UK agri-food sector emissions inventory, and thus appears to have a lower carbon footprint than other livestock industries, since much of the feed fed to UK poultry is imported its actual footprint especially where it has led to land-use change overseas, is much greater<sup>9</sup>.

GHG emissions in the poultry sector originate from various operational sources, notably feed and associated crop production practices, water, housing, land, energy (in the form of gas, oil, and electricity), manure, and bedding. Feed contributes to over 70% of the industry’s total emissions, largely due to the unsustainable cultivation of externally sourced soybeans, often linked to deforestation in South America<sup>10 11</sup>. In 2019, an industry spokesman stated approximately 3.3 million tons of livestock feeds are imported annually into the UK, with nearly 60% being utilised by the poultry sector<sup>12</sup>. Thus, achieving net-zero emissions in the UK poultry industry would entail reducing GHG emissions to a level where any remaining emissions are offset by measures to increase the level of carbon sinks in the environment<sup>13</sup>. In a quantified sense, this would involve several key actions and outcomes, such as emission reduction targets, transition to renewable energy and more sustainable feed sources, carbon offsetting measures, innovative technology adoption, supply chain optimisation, data monitoring and reporting<sup>14</sup>. This report contributes to work to deliver emission reduction through understanding how poultry sector stakeholders currently understand efforts to address net zero in conjunction with visions of future chicken.

The Agri-chicken for Net Zero project is an interdisciplinary research team, cutting across five UK universities and industry partners that was awarded a UKRI scoping study grant of £50k through the AFN Network+ to explore the net zero question in UK

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<sup>7</sup> ‘Committee on Climate Change’s 2020 Progress Report: Government Response’, *GOV.UK* <<https://www.gov.uk/government/publications/committee-on-climate-changes-2020-progress-report-government-response>> [accessed 16 May 2024].

<sup>8</sup> ‘World Emissions Clock’ <<https://worldemissions.io/>> [accessed 16 May 2024].

<sup>9</sup> CIEL, ‘Net Zero & Livestock. How Farmers Can Reduce Emissions’, 2022 <<https://cielivestock.co.uk/wp-content/uploads/2022/02/CIEL-LR-220405.pdf>>.

<sup>10</sup> CIEL.

<sup>11</sup> Xiao-Peng Song and others, ‘Massive Soybean Expansion in South America since 2000 and Implications for Conservation’, *Nature Sustainability*, 4.9 (2021), pp. 784–92, doi:10.1038/s41893-021-00729-z. (accessed on 4 January 2024).

<sup>12</sup> Chloe Ryan, ‘Feature: A Roadmap for Sustainable Poultry Feed’, *Poultry News*, 2019 <<https://www.poultrynews.co.uk/news/feature-a-roadmap-for-sustainable-poultry-feed.html>> [accessed 16 May 2024].

<sup>13</sup> ‘Sixth Carbon Budget’, *Climate Change Committee* <<https://www.theccc.org.uk/publication/sixth-carbon-budget/>> [accessed 16 May 2024].

<sup>14</sup> CIEL.

poultry and where it sits in wider related conversations about industry change. In this scoping project, ‘Changing Chicken for Net Zero’, the aim is to advance understanding of how industry stakeholders understand opportunities for action, both their own and others, within the poultry food system to support the UK government’s 2022 Net Zero Strategy for the agri-food system.

*This report contributes to work to deliver emission reduction through understanding how poultry sector stakeholders currently understand efforts to address net zero in conjunction with visions of future chicken.*

This report summarises the main findings from an in-person workshop with poultry industry stakeholders held on Friday, 1st December 2023, from 9.30 a.m. to 4 p.m. at the Applied Group Office in Chesterfield. The workshop brought together stakeholders working in the chicken industry, covering welfare, production, breeding, nutrition, health, business and consumption, along with the interdisciplinary research team. This report reflects the industry beliefs and practices around the poultry industry’s response to net zero and potential changes in the coming decade or so to meet net zero targets. Consequently, the conversations generated by activities reflect how actions to meet net zero are currently known, understood and envisaged. The conversations also reflect where beliefs lie about what changes appear hard to envisage as feasible.

Workshop participants included 6 people working as poultry industry middle managers and technicians, 2 people working as poultry industry communication specialists and one person involved in poultry industry science separate to the project’s research team (Table 1). The full research team of this project took part in the workshop as well.

*Table 1 List of participants expertise*

<b>Stakeholders</b>	<b>Field of Expertise</b>
Participant 1	Agricultural consultant
Participant 2	Poultry scientist
Participant 3	Development of remote automated poultry management
Participant 4	Poultry technician (remote)
Participant 5	Marketing officer
Participant 6	Commercial manager feed manufacturer
Participant 7	Managing Director in poultry management



Participant 8	Research and development in poultry contract farming
Participant 9	Animal Welfare Researcher
Participant 10	Social Science Researcher

The workshop was facilitated by Dr Paul Hurley with support from Prof Emma Roe, both from the University of Southampton. The day was split into four activities, each with their own subject, starting with the novel Build-A-Chick (Activity 1), followed by activities to identify changes to the chicken industry past, present and future (Activities 2-4 respectively). For each activity, participants were asked to change groups, so each group consisted of a different set of participants. This enabled participants to interact with people from various backgrounds during the day. Section 2 summarises key findings in terms of progression of the poultry industry towards net zero. For details on the procedures and content of the workshop activities please read our other report **Changing Agri-Chicken for Net Zero. Report on Participatory Workshop Methodology and detailed findings.**

## 2. Key Themes raised by the poultry industry in relation to net zero

The key themes below were identified through analysing how participants engaged and contributed to activities 3 and 4 of the workshop (i.e. questions regarding the current and future of UK poultry). How and why these themes are important can be understood in relation to the findings from activities 1 and 2. From activity 1, we learnt, for example, how the poultry industry understands the relationship between poultry production and the (farmed) environment, and in activity 2, the growth of the poultry industry was highlighted, including drivers behind this growth.

### 2.1 Accounting for net zero

Currently, the focus within the UK poultry industry primarily revolves around controlling the 5% of emissions related to on-farm activities, such as gas and electricity usage and switching to non-fossil fuel sources. Indeed, from the discussion we heard, for many the 70% of off-farm emissions, a high proportion of which is linked to overseas feed crop production, is often absent from discussions. Life cycle assessments<sup>15 16</sup> of carbon emissions would address this and participants recognised the need for this approach. This involves accounting for emissions not only from direct sources but also from indirect sources like feed production and land use changes. Incentivising sustainable practices through policy interventions and financial

<sup>15</sup> Mario Herrero and others, 'Greenhouse Gas Mitigation Potentials in the Livestock Sector', *Nature Climate Change*, 6.5 (2016), pp. 452–61, doi:10.1038/nclimate2925.

<sup>16</sup> Graham A. McAuliffe, Taro Takahashi, and Michael R. F. Lee, 'Framework for Life Cycle Assessment of Livestock Production Systems to Account for the Nutritional Quality of Final Products', *Food and Energy Security*, 7.3 (2018), p. e00143, doi:10.1002/fes3.143.

mechanisms can encourage poultry producers and other stakeholders<sup>17</sup>. This could include carbon pricing, subsidies for low-carbon technologies, or tax incentives for implementing sustainable practices.

Poultry industry participants argued for the significant potential the poultry industry holds to contribute to environmental sustainability. They noted, for example, that poultry has a lower carbon footprint when measured in relation to ruminant livestock for GHG. They felt therefore an opportunity exists for a shift towards consuming less beef and incorporating more poultry into diets<sup>18</sup>. This shift, they argued, is not only beneficial in terms of reducing CO<sub>2</sub> emissions but also in terms of conserving water and land resources. In this counter framing of a more carbon-efficient poultry industry<sup>19</sup>, they are keen to cast their industry as a viable solution in the quest for agri-food net zero.

*I believe the amount of pressure put on farmers is not justifiable for the volume of emissions they produce.*

***“I believe the amount of pressure put on farmers is not justifiable for the volume of emissions they produce. That’s me as a farmer talking... I think that speaks for agriculture as a whole really. I mean we are feeding the whole world, and deemed as evil for what we produce.”*** Participant 7 Managing Director in poultry management.

***“Yeah, we don’t hear people complain about going on planes for the emissions they produce, but we hear about how bad it is to eat chicken.”*** Participant 1, Agricultural Consultant.

And they also argued that chicken is a low-cost, albeit often processed, form of affordable protein, particularly in the face of the cost-of-living crisis<sup>6</sup>, for disadvantaged UK households.

***“I would say the cost-of-living crisis has probably helped the industry. Chicken is the cheapest meat. If you're buying, you might have to substitute beef or something for more chicken. It's probably the most cost-efficient way of getting protein. So, we see that growing. It's still the number one meat.”*** Participant 6 Commercial Manager, Feed Manufacturer

While withdrawal of cheap chicken may mitigate some environmental and welfare issues<sup>32</sup>, this could have far-reaching implications for human welfare, including decreased access to protein, particularly for low-income individuals and communities, impacting their nutritional

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<sup>17</sup> Anne Mottet and others, ‘Livestock: On Our Plates or Eating at Our Table? A New Analysis of the Feed/Food Debate’, *Global Food Security*, Food Security Governance in Latin America, 14 (2017), pp. 1–8, doi:10.1016/j.gfs.2017.01.001.

<sup>18</sup> ‘Tackling Climate Change through Livestock. A Global Assessment of Emissions and Mitigation Opportunities [Policy Support and Governance] Food and Agriculture Organization of the United Nations’ <<https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1235389/>> [accessed 17 May 2024].

<sup>19</sup> Gržinić and others.

intake and food security<sup>20 21</sup>. This underscores the need for multifaceted approaches to address these complex challenges while ensuring access to affordable, nutritious, sustainable, and net-zero food for all.

## 2.2 Animal Feed (soya beans) and farm emissions

The current approach to achieving net zero status in animal feed companies involves variations in rules and calculations, with many using the GFLI metrics. Global metrics For Sustainable Feed (GFLI metrics) are used by animal feed companies to measure their progress to achieving net zero status. Global Feed Life Cycle Analysis (LCA) Institute to assess the environmental impacts associated with the production and use of animal feed<sup>22</sup>. The issue of soya-based proteins is intriguing, given the ongoing research on alternative proteins that are available but do not facilitate rapid growth in birds<sup>23</sup>. Implementing these alternatives at industrial scale would make the growth period for birds approximately a third longer, participants estimated. This presents a significant economic challenge for the broiler industry, requiring substantial investment to maintain chicken production levels as new guidelines are introduced that require European free range broiler chickens to be kept for a longer growth period (56 days)<sup>24</sup> and this is also the requirement for the Better Chicken Commitment in the UK<sup>25</sup>. Reducing the growth rate of birds leads to increased emissions in various aspects such as floor space, additional farms, storage, chilling, and transportation. This slower growth necessitates a larger infrastructure, contributing to elevated emissions.

In discussions concerning insect protein, it was noted that while there are regulatory restrictions, there is a technical possibility they could contribute to a viable feed alternative. However, participants expressed uncertainty about people's willingness to consume chicken fed on insects. Additionally, participants noted that South America is the primary global exporter of soya beans, which underscores net zero as internationally flexed in the sense that a shift to more sustainable feed may necessitate regulation beyond the UK. Participants reflected that profits for both soya farmers and chicken farmers remain low, often yielding minimal returns per liveweight. A considerable share of the earnings is claimed by middlemen, a trend common across various agri-food industries.

Ensuring the preservation of the rainforest and reducing deforestation for soya growth is crucial and finding alternative protein sources for chicken feed is a collective responsibility that involves collaboration between the government, integrators, and various stakeholders.

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<sup>20</sup> Pete Smith and others, 'How Much Land-Based Greenhouse Gas Mitigation Can Be Achieved without Compromising Food Security and Environmental Goals?', *Global Change Biology*, 19.8 (2013), pp. 2285–2302, doi:10.1111/gcb.12160.

<sup>21</sup> Alice Garvey and others, 'Towards Net Zero Nutrition: The Contribution of Demand-Side Change to Mitigating UK Food Emissions', *Journal of Cleaner Production*, 290 (2021), p. 125672, doi:10.1016/j.jclepro.2020.125672.

<sup>22</sup> 'GFLI Methodology and Project Guidelines'.

<sup>23</sup> Thornton, Gurney-Smith, and Wollenberg.

<sup>24</sup> *Commission Regulation (EC) No 543/2008 of 16 June 2008 Laying down Detailed Rules for the Application of Council Regulation (EC) No 1234/2007 as Regards the Marketing Standards for Poultrymeat, OJ L*, 2008, CLVII <<http://data.europa.eu/eli/reg/2008/543/oj/eng>> [accessed 17 May 2024].

<sup>25</sup> 'The Policy - BCC [UK]' <<https://betterchickencommitment.com/uk/policy/>> [accessed 17 May 2024].

Participants recognised the need for a unified effort to address the complex challenges and identify sustainable alternatives and a shift to more sustainable feed.

### 2.3 Feed alternatives, supply chains and responsibility

*Locating where small and large-scale opportunities for carbon reduction exist*

***“There’s a perception that the supermarkets make lots of money, more than everybody else... The industry voice is pretty weak.”*** Participant 6 Commercial Manager, Feed Manufacturer

The pursuit of net-zero emissions is a shared objective within the industry as acknowledged by participants. However, the primary source of concern remains soya beans, as it significantly contributes to the carbon footprint<sup>26 27</sup>. Despite widespread efforts, companies are grappling with the challenge of finding a viable replacement for soya beans. Currently, a conclusive solution has not emerged, emphasizing the complexity and urgency of addressing this key issue in the industry. It was noted in the workshop that over 70% of emissions are external (attributable to soya bean-based poultry feed) and so we heard farmer’s feel this is out of their control. Typically, farmers are given the feed by the poultry integrator for whom they are contracted to grow chickens. Consequently, it is only 7% of carbon emissions that can be attributed to the workings of the farm, including transport and miscellaneous factors.

Despite these supply chain arrangements, more pressure, it was felt, is often placed on the farmers when discussing responsibilities towards achieving net zero. Participant 7, Managing Director in poultry management, expressed it thus: ***“I would say, I know everybody has to chip in for the net zero, but I believe the pressure on the farmers is not justifiable to the amount of emissions they produce on the farm. That’s me just as the farmer talking. So the farmers are unfairly in the spotlight for that. Other people need to take a bit more responsibility.”***

From the farmers’ perspective, this indicates an unequal and unfair responsibility towards achieving net zero in the supply chain and raises the salient question of governance in the poultry value chain.

***I would say, I know everybody has to chip in for the net zero, but I believe the pressure on the farmers is not justifiable to the amount of emissions they produce on the farm.***

<sup>26</sup> CIEL.

<sup>27</sup> Xiao-Peng Song and others, ‘Massive Soybean Expansion in South America since 2000 and Implications for Conservation’, *Nature Sustainability*, 4.9 (2021), pp. 784–92, doi:10.1038/s41893-021-00729-z.

The global challenge of finding an alternative to soya protein for poultry feed came up a lot in discussions<sup>28</sup>. Despite this widespread concern, participants noted the disproportionate focus on the 5% of emissions within the industry. Farmers, it was noted, have made considerable efforts, adopting solar energy for heating, and implementing measures to reduce ammonia emissions by maintaining sheds. However, beyond these steps, there appears to be limited actionable strategies to address emission reduction further at the farm-gate. Instead, they recognised that wider supply chain actions are possible. Opportunities to reduce carbon emissions can be found across the UK meat supply chain, but responsibility to act and influence change is less evenly distributed.

The dominant poultry operating model in the UK poultry industry involves contract farmers working with integrators, where companies provide the chicks and food, covering over 80% of the business. The alternative model is the wholesale market, constituting 10 to 20% of the business. However, even in the wholesale market, choices are limited, with only a few mills supplying feed. Farmers, it was pointed out, consequently have limited influence as they receive what the integrators or suppliers can provide based on availability and factors beyond their control. Information on how to address net zero can be provided to poultry farmers, but the options remain subject to integrators' decisions and commercial availability of the alternatives. Large processors are also involved in what are effectively highly integrated systems. Processors, as participants explained, collaborate with breeders, broilers, and layers, establishing a structured and coordinated approach across different stages of the chicken production process.

*Information on how to address net zero can be provided to poultry farmers, but the options remain subject to integrators' decisions and commercial availability of the alternatives.*

There is good awareness about net-zero across the supply chain, according to participants, with integrators being proactive about how to meet the government deadlines for net zero action. At the farm-level, farming practices involve diverse production systems, including free-range, organic, and intensive indoor operations in small and large scales.<sup>29</sup> Each poultry system presents unique challenges and opportunities for reducing emissions and improving sustainability.

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<sup>28</sup> Philip Thornton, Helen Gurney-Smith, and Eva Wollenberg, 'Alternative Sources of Protein for Food and Feed', *Current Opinion in Environmental Sustainability*, 62 (2023), p. 101277, doi:10.1016/j.cosust.2023.101277.

<sup>29</sup> Ben Sassi, Averós, and Estevez.

Turning to poultry processing facilities energy-intensive operations such as chilling, packaging, and transportation typically occur in this space<sup>30</sup>. Retail outlets and consumers also influence emissions across the poultry supply chain through purchasing decisions and food waste. For instance, participants noted increased demand for fresh chicken meat rather than frozen. Predicting supply and demand also poses challenges due to the limited holding capacity within the supply chain, primarily restricted to chillers. The preference for fresh over frozen meat impacts the market dynamics, even though there is no inherent difference between the two, as frozen meat is essentially freshly frozen. The frozen market is undervalued, offering a more affordable option. New chiller technologies, initially designed for lamb in New Zealand, have been introduced. These flash freezers, while not freezing the meat entirely, allow meat freshness to be extended for up to six weeks. The application of this technology means the carbon emissions for what appears fresh chicken through this chilling technology, increases.

*Achieving net zero targets will not be easy because of the low-level of synergistic working across the chicken industry, combined with the vertical structure and competitive nature of the industry.*

In summary, participants in the workshop pointed out, achieving net zero targets will not be easy because of the low-level of synergistic working across the chicken industry, combined with the vertical structure and competitive nature of the industry.

## 2.4 Intersecting sustainability challenges (net zero, biosecurity, animal ethics and welfare).

### *Frustration about poor environmental reputation*

It was voiced that the industry is perceived as having a bad reputation for not being environmentally friendly and that this is framed more widely than the issue of net zero.

***“Sometimes I do worry about the perception of the industry. I think a lot of people focus on things like the sustainability of meat and things like that. I think it's a bit disingenuous because when you dig down to it, it all comes down to the fact that they don't agree with meat production in general. I did, have had, a spirited discussion with somebody I knew they were talking about it and they said that they didn't eat meat because it's bad for the environment. So I said if we produced a Net-Zero chicken, would you eat it? And they said no. Well, then...”*** Participant 6, Commercial Manager, Feed Manufacturer.

<sup>30</sup> ‘Unpacking the Meat Industry | Richmond Fed’  
<[https://www.richmondfed.org/publications/research/econ\\_focus/2020/q4/feature1](https://www.richmondfed.org/publications/research/econ_focus/2020/q4/feature1)> [accessed 17 May 2024].

Here we can witness the umbrella term ‘sustainability’ being bundled in this reported exchange with sentiments against eating meat/animals and animal welfare, alongside concerns that meat has a higher carbon footprint. And the term ‘bad for the environment’ may refer to concerns about environmental pollution from the poultry industry, which again does not refer to Net-Zero. Any positive messaging around zero-carbon chicken may still not address other associations it holds to environmental harms.

It is notable the frustration towards consumers who were opting to not eat (chicken) meat.

***“If you look at the motivations behind a lot of the bad press, we see it comes down to that simple question and some are perfectly within their rights to say they don't want to eat meat. That's fine. But it's when they make it out to be for a specific reason, but meaning another, that it's not.”*** Participant 1 Agricultural Consultant.

Another example of frustration we heard was when people misinterpret information shared about their industry:

***“People think that when chickens lie down with their legs sticking out, they are in distress, but they are just resting. That is how chickens lie.”*** Participant 5, Marketing Officer

Yet relatedly, we also heard from the participants about the active secrecy around poultry units, attempts to hide sheds in the landscape by newly-planted trees, which helps to explain why poultry farming is consequently poorly understood as the reality and imagination of poultry consumers can be quite different. We heard the wish that farmers could prove that they do care for chickens.

***We try and hide our sheds. We plant trees around them, because we don't want anyone to see them, because chicken is deemed as bad.***

***“...some of them [farmers] that I speak to, they feel that they would love to be able to speak to the consumer, like ‘we actually care, this is how we can prove it to you’. Day in, day out. Sometimes it will go wrong, but I think consumers are so far removed from what we do, that if we tell them what we're doing and we're doing it well, they're still shocked. Because they don't think of 40,000 chickens in a shed. They're thinking of 5 or 10 in a field. And then you're just shooting yourself in the foot. We try and hide our sheds. We plant trees around them, because we don't want anyone to see them, because chicken is deemed as bad”.*** Participant 7, Managing Director in Poultry Management

#### *Responses to corporate pressure to change production practices*

Could the industry adapt and change to win the argument with those consumers avoiding eating chicken? Workshop participants felt there was a need to increase consumer awareness and engagement to alter misconceptions that the industry was not working to reduce their carbon footprint.

***“We are the largest feed manufacturer, and we want to keep it that way. So, we wanna be leading the way on finding alternatives to soya by running various feed trials, and it's also***

*what our customers are interested in*". Participant 6 Commercial Manager, Feed Manufacturer.

Farmers supplying supermarkets are required to report on the carbon footprint of their poultry feed. *"So, if the customer wants something, we look at it. You know the supermarkets are driving our customers, they all have to report on things like carbon footprint. So that means we now have to report on the carbon footprint of their [chickens] feed. That is something they've asked for."* participant 6 Commercial Manager, Feed Manufacturer.

Additionally, there was a growing concern about the slogan 'grow less and better, eat less and better'<sup>31</sup> advocated for by an alliance of environmental and animal welfare charities, public health and social justice organisations.

*"I'm disappointed really because it seems to be the prevailing view of the [food] industry that eating less meat is better for the environment, but we still need the protein. And I feel like there's a lot of misunderstanding on where we can get alternative protein from. Eggs, but we still need to grow chickens for eggs. People talk a lot about, you know, the alternative protein sources, things like soya. Why don't we eat soya directly? Get the protein, the protein structure matters, yeah"*. Participant 1 Agricultural Consultant

With pointed response from Participant 6 Commercial Manager, Feed Manufacturer *"You can get 100 grams of protein, but the structure of the protein matters and meat, whether they like it or not, meat is closer to the ideal protein for us. So its whether we need to eat less..."*

It is interesting here that whilst the language of nutritional science is used to discuss this point, there is no mention of the environmental science behind the slogan. Again, the industry participants contributing to this discussion are keen to argue for why meat should be still eaten, and why non-meat alternatives are not viable.

In recent times, the growing concern for animal welfare by poultry scientists, food safety experts and consumers has led to heightened debate on the acceptability of chicken as a cheap animal protein, and raising questions as to whether it should be withdrawn from the market<sup>32 33</sup>. In contrast participants talked about how negative views on welfare and sustainability were driven by the media, rather than drawing on their own experiences and reflections on how chicken is produced, or

*Participants talked about how negative views on welfare and sustainability were driven by the media, rather than drawing on their own experiences and reflections on how chicken is produced, or poultry welfare and food safety scientific expertise that state current poultry systems are unacceptable.*

<sup>31</sup> 'Why Less and Better?' <<https://www.eating-better.org/who-we-are/why-eat-less-better/>> [accessed 17 May 2024].

<sup>32</sup> 'Welfare of Broilers and Laying Hens on Farm | EFSA', 2023 <<https://www.efsa.europa.eu/en/infographics/welfare-broilers-and-laying-hens-farm>> [accessed 17 May 2024].

<sup>33</sup> Social Market Foundation. (2023). Eating less cheap chicken is the key to animal welfare, think tank says - Social Market Foundation. Available at: 'Tackling Climate Change through Livestock. A Global Assessment of Emissions and Mitigation Opportunities |Policy Support and Governance| Food and Agriculture Organization of the United Nations' <<https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1235389/>> [accessed 17 May 2024].



poultry welfare and food safety scientific expertise that state current poultry systems are unacceptable<sup>34</sup>.

Participant 7 Managing Director in Poultry Management expressed; ***“They [consumers] really have no idea. The only thing that they know about chicken farming really is what animal right’s activists are putting out there because the industry doesn’t really have a voice. So, they just see all the negative press.”*** This was immediately reinforced by participant 1 Agricultural Consultant: ***“I think the industry doesn’t have a voice because of the negative press”***.

## 2.5 Technology, circularity and ‘future chicken’ imaginaries.

### *Semi-autonomous technology roll-out to increase production efficiency.*

Semi-autonomous technological innovation has characterised recent transformations, including dealing with challenges, in how poultry is farmed, but also facilitating scaling-up whilst driving down costs. This has included sensors, computers, and cameras to help monitor, manage and coordinate production activities for efficiency<sup>35</sup>. For instance, sensors and cameras are used for observing the behaviour of chickens, to provide indicators for poultry welfare, health and growth<sup>36</sup>. Currently, the major drivers of technology in the industry are maintaining profit margins, addressing labour shortages and biosecurity controls. As yet, apart from renewable energy there has been no magic biotechnological bullet to make a game-changing shift in the carbon footprint of chicken, just ongoing small efficiencies from scaling up and reducing labour through monitoring technology.

*Apart from renewable energy there has been no magic biotechnological bullet to make a game-changing shift in the carbon footprint of chicken, just ongoing small efficiencies from scaling up and reducing labour through monitoring technology.*

For example, labour shortages are a major concern in chicken farming, and workshop participants reflected that the type of poultry industry worker has changed from what it used to be in the past. As noted by participant 1: ***“Yeah, the type of people on the farm has started changing. Originally it was farmers and now it’s workers. And then you need this support from the technology to help with the work because we don’t have the skillset of the people who used to do it”***. With technology, one person can easily manage four sheds of about 180,000 birds depending on the site, working 24 hours a day for continuous technology-assisted monitoring of the birds. The increasing incorporation of technology in poultry farming aims to enhance the ease of tasks for farm staff, but can never remove them entirely, such as daily walks through the chickens to carry out health and welfare checks including removing

<sup>34</sup> ‘Welfare of Broilers and Laying Hens on Farm | EFSA’.

<sup>35</sup> A Khadivar, F Mojibian, and Z Torkashvard, ‘Recognizing and Prioritizing Smart Solutions in the Poultry Industry Based on Sustainability Criteria’, *Journal of Agricultural Economics and Development*, Online First, 2022, doi:10.22067/jead.2022.76267.1130.

<sup>36</sup> Neila Ben Sassi, Xavier Averós, and Inma Estevez, ‘Technology and Poultry Welfare’, *Animals*, 6.10 (2016), p. 62, doi:10.3390/ani6100062.

dead birds, for which no technological solution exists. Acknowledging the challenges in attracting the next generation of farm workers, the hope is that technological advancements will contribute to the overall efficiency and attractiveness of poultry farming as a career.

Against this context, it is perhaps not surprising that our participants were very clear that they saw the adoption of technological opportunities and innovations in the UK's poultry industry as essential for achieving net-zero emissions. They described the potential of technological innovations to improving farming practices, integrating renewable energy, managing waste more sustainably, reducing carbon emissions, promoting sustainable feed production, enhancing supply chain transparency, and ensuring environmental compliance. By integrating renewable energy sources into farm operations, poultry producers can lower carbon emissions associated with electricity consumption and heating requirements<sup>37</sup>. However, against the backdrop of the 70% attributed to soya bean-based feed these opportunities seem small wins. These were the only ways forward to address net zero that the participants presented.

*It is perhaps not surprising that our participants were very clear that they saw the adoption of technological opportunities and innovations in the UK's poultry industry as essential for achieving net-zero emissions.*

#### *Anaerobic digestors converting poultry waste into biogas and organic fertiliser.*

Anaerobic digestion (AD) plants convert poultry waste, such as manure and bedding material, into biogas and organic fertilisers. The evolving trend in AD plants, particularly their increased presence in the UK, is notable according to workshop participants. There is a growing emphasis on utilising chicken manure as AD fuel to produce biogas through anaerobic digestion, subsequently generating electricity and heat via bio generators<sup>38</sup>. This represents a circular economy model with potential benefits for farming businesses, exemplified by a successful case involving a farmer who incorporates both AD plants and chicken farming into their operations. This approach represents a promising avenue for sustainable and efficient agricultural practices towards achieving net zero. In 2020, AD in the UK contributed 1,021 thousand tonnes of oil equivalent to the total energy output, with electricity generated from AD representing the largest portion, accounting for 953 thousand tonnes of oil equivalent<sup>39</sup>.

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<sup>37</sup> Y. Li and others, 'Design Considerations for Net Zero Energy Buildings for Intensive, Confined Poultry Production: A Review of Current Insights, Knowledge Gaps, and Future Directions', *Renewable and Sustainable Energy Reviews*, 154 (2022), p. 111874, doi:10.1016/j.rser.2021.111874.

<sup>38</sup> Dan Brown and Yebo Li, 'Solid State Anaerobic Co-Digestion of Yard Waste and Food Waste for Biogas Production', *Bioresource Technology*, 127 (2013), pp. 275–80, doi:10.1016/j.biortech.2012.09.081.

<sup>39</sup> DEFRA. (2021). Anaerobic Digestion Plant Statistics. <https://www.gov.uk/government/statistics/anaerobic-digestion-plant-statistics-2020>.

While AD technology provides sustainable solutions for waste management, renewable energy production, and soil fertility enhancement, each offering environmental and economic benefits, there are challenges. These are high initial costs, operational complexity, regulatory compliance, and public perception issues, including concerns about odour, noise and environmental impact, hinder widespread implementation according to participants. As a result, the poultry industry still depends largely on fossil fuel for heating and electricity.

## 2.6 Summary Bullet Points

1. Industry participants agreed that life cycle assessments had to be used in net zero accounting processes. A unified effort to address net zero was required across the poultry industry, with each playing their part.
2. Frustration expressed with the size of the effort into on-farm carbon reduction when this is only 5% of the footprint, pointing particularly at poultry feed making up 70%
3. Concern that an alternative to soya beans is not currently available, and that the responsibility for addressing this lay with the poultry processors/integrators who manage 80% of the UK poultry sector.
4. Reluctance to acknowledge scientific evidence that the poultry industry has a poor sustainability and poor poultry welfare record, tending to consider negative media that is responsible for its bad reputation on the intersecting sustainability challenges it faces.
5. Hope is placed nearly exclusively in (bio) technological solutions to address the net zero challenge, as in keeping with what has enabled the poultry industry to grow and expand over the last 50 years.

Our ongoing thinking is leading us to focus on:

- Agency and responsibility in poultry net zero governance (integrators and retailers);
- A system that econometrically signifies 'success' that is now challenged (so perceived sense of unfairness) and efficiency solutions as cultural lock-ins (for system resilience);
- A more 'radical' food system transformation would consider sustainable diets and less meat (as well as efficiency and circularity) but possibly too investments in alternative proteins and shifts in production geography to spatially extended arrangements whereby e.g. Brazil farms meat not just protein for meat.

### 3. References

- Bedford, Emma, *Poultry in the United Kingdom*, 2024  
<<https://www.statista.com/topics/6102/poultry-in-the-united-kingdom/>> [accessed 17 March 2024]
- Ben Sassi, Neila, Xavier Averós, and Inma Estevez, ‘Technology and Poultry Welfare’, *Animals*, 6.10 (2016), p. 62, doi:10.3390/ani6100062
- Bridle, S. L., *Food and Climate Change without the Hot Air: Change Your Diet: The Easiest Way to Help Save the Planet*, 1st edition (UIT Cambridge Ltd., 2020)
- Brown, Dan, and Yebo Li, ‘Solid State Anaerobic Co-Digestion of Yard Waste and Food Waste for Biogas Production’, *Bioresource Technology*, 127 (2013), pp. 275–80, doi:10.1016/j.biortech.2012.09.081
- ‘Chicken Meat Production’, *Our World in Data* <<https://ourworldindata.org/grapher/chicken-meat-production?tab=chart&country=~GBR>> [accessed 17 March 2024]
- CIEL, ‘Net Zero & Livestock. How Farmers Can Reduce Emissions’, 2022  
<<https://cielivestock.co.uk/wp-content/uploads/2022/02/CIEL-LR-220405.pdf>>
- Commission Regulation (EC) No 543/2008 of 16 June 2008 Laying down Detailed Rules for the Application of Council Regulation (EC) No 1234/2007 as Regards the Marketing Standards for Poultrymeat*, OJ L, 2008, CLVII  
<<http://data.europa.eu/eli/reg/2008/543/oj/eng>> [accessed 17 May 2024]
- ‘Committee on Climate Change’s 2020 Progress Report: Government Response’, *GOV.UK*  
<<https://www.gov.uk/government/publications/committee-on-climate-changes-2020-progress-report-government-response>> [accessed 16 May 2024]
- Garvey, Alice, Jonathan B. Norman, Anne Owen, and John Barrett, ‘Towards Net Zero Nutrition: The Contribution of Demand-Side Change to Mitigating UK Food Emissions’, *Journal of Cleaner Production*, 290 (2021), p. 125672, doi:10.1016/j.jclepro.2020.125672
- ‘GFLI Methodology and Project Guidelines’
- Gržinić, Goran, Agnieszka Piotrowicz-Cieślak, Agnieszka Klimkowicz-Pawlas, Rafał L. Górny, Anna Ławniczek-Wałczyk, Lidia Piechowicz, and others, ‘Intensive Poultry Farming: A Review of the Impact on the Environment and Human Health’, *Science of The Total Environment*, 858 (2023), p. 160014, doi:10.1016/j.scitotenv.2022.160014
- Herrero, Mario, Benjamin Henderson, Petr Havlík, Philip K. Thornton, Richard T. Conant, Pete Smith, and others, ‘Greenhouse Gas Mitigation Potentials in the Livestock Sector’, *Nature Climate Change*, 6.5 (2016), pp. 452–61, doi:10.1038/nclimate2925
- Khadivar, A, F Mojibian, and Z Torkashvard, ‘Recognizing and Prioritizing Smart Solutions in the Poultry Industry Based on Sustainability Criteria’, *Journal of Agricultural Economics and Development*, Online First, 2022, doi:10.22067/jead.2022.76267.1130

- Li, Y., V. Arulnathan, M.D. Heidari, and N. Pelletier, ‘Design Considerations for Net Zero Energy Buildings for Intensive, Confined Poultry Production: A Review of Current Insights, Knowledge Gaps, and Future Directions’, *Renewable and Sustainable Energy Reviews*, 154 (2022), p. 111874, doi:10.1016/j.rser.2021.111874
- McAuliffe, Graham A., Taro Takahashi, and Michael R. F. Lee, ‘Framework for Life Cycle Assessment of Livestock Production Systems to Account for the Nutritional Quality of Final Products’, *Food and Energy Security*, 7.3 (2018), p. e00143, doi:10.1002/fes3.143
- Mottet, Anne, Cees de Haan, Alessandra Falcucci, Giuseppe Tempio, Carolyn Opio, and Pierre Gerber, ‘Livestock: On Our Plates or Eating at Our Table? A New Analysis of the Feed/Food Debate’, *Global Food Security*, Food Security Governance in Latin America, 14 (2017), pp. 1–8, doi:10.1016/j.gfs.2017.01.001
- ‘NFU Poultry Sector Business Resilience Plan’ <<https://www.nfuonline.com/updates-and-information/poultry-sector-resilience-plan/>> [accessed 16 May 2024]
- Ryan, Chloe, ‘Feature: A Roadmap for Sustainable Poultry Feed’, *Poultry News*, 2019 <<https://www.poultrynews.co.uk/news/feature-a-roadmap-for-sustainable-poultry-feed.html>> [accessed 16 May 2024]
- ‘Sixth Carbon Budget’, *Climate Change Committee* <<https://www.theccc.org.uk/publication/sixth-carbon-budget/>> [accessed 16 May 2024]
- Smith, Pete, Helmut Haberl, Alexander Popp, Karl-heinz Erb, Christian Lauk, Richard Harper, and others, ‘How Much Land-Based Greenhouse Gas Mitigation Can Be Achieved without Compromising Food Security and Environmental Goals?’, *Global Change Biology*, 19.8 (2013), pp. 2285–2302, doi:10.1111/gcb.12160
- Song, Xiao-Peng, Matthew C. Hansen, Peter Potapov, Bernard Adusei, Jeffrey Pickering, Marcos Adami, and others, ‘Massive Soybean Expansion in South America since 2000 and Implications for Conservation’, *Nature Sustainability*, 4.9 (2021), pp. 784–92, doi:10.1038/s41893-021-00729-z
- ‘Tackling Climate Change through Livestock. A Global Assessment of Emissions and Mitigation Opportunities |Policy Support and Governance| Food and Agriculture Organization of the United Nations’ <<https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1235389/>> [accessed 17 May 2024]
- ‘The Policy - BCC [UK]’ <<https://betterchickencommitment.com/uk/policy/>> [accessed 17 May 2024]
- Thornton, Philip, Helen Gurney-Smith, and Eva Wollenberg, ‘Alternative Sources of Protein for Food and Feed’, *Current Opinion in Environmental Sustainability*, 62 (2023), p. 101277, doi:10.1016/j.cosust.2023.101277
- ‘Unpacking the Meat Industry | Richmond Fed’ <[https://www.richmondfed.org/publications/research/econ\\_focus/2020/q4/feature1](https://www.richmondfed.org/publications/research/econ_focus/2020/q4/feature1)> [accessed 17 May 2024]

- ‘Welfare of Broilers and Laying Hens on Farm | EFSA’, 2023  
<<https://www.efsa.europa.eu/en/infographics/welfare-broilers-and-laying-hens-farm>>  
[accessed 17 May 2024]
- ‘Why Less and Better?’ <<https://www.eating-better.org/who-we-are/why-eat-less-better/>>  
[accessed 17 May 2024]
- ‘World Emissions Clock’ <<https://worldemissions.io/>> [accessed 16 May 2024]

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